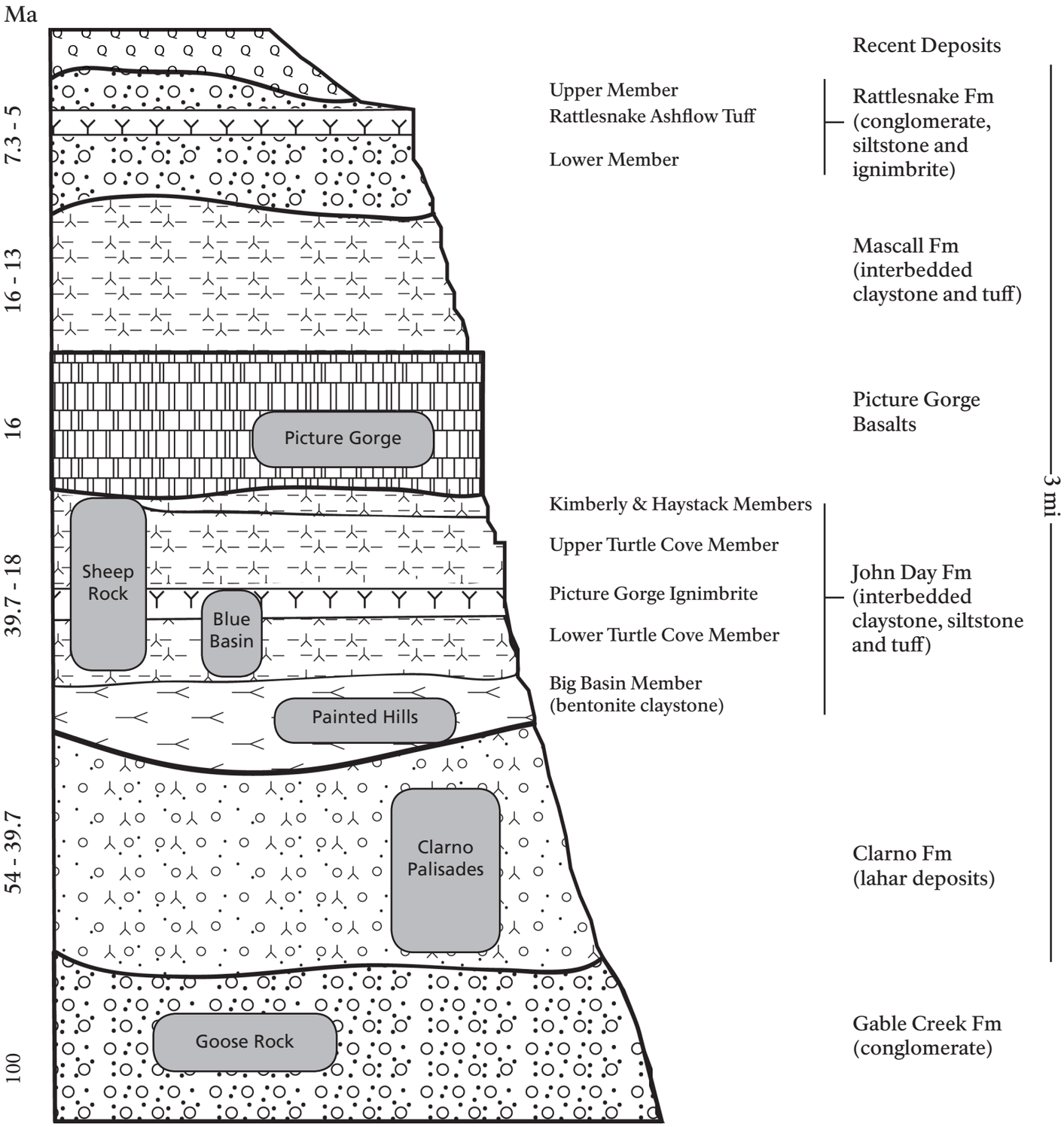
Geology of John Day Fossil Beds

National Park Service
U.S. Department of the Interior

John Day Fossil Beds
National Monument

Standing at almost any locality in the monument, views of distinctive rock layers abound. Each layer is a window into the past, preserving the fossilized remains of plants and animals, both familiar and strange. It is unlikely that a more complete and well-preserved record of Cenozoic terrestrial life exists anywhere in the world. For this reason, researchers from around the globe come here to share in the wonder of studying these amazing fossils. Examining the differences between each of the geologic strata helps researchers better understand how the region has changed through time. As knowledge about each of the layers grows, fundamental questions pertaining to the environment, climate, and the ancient life in western North America can be answered, providing a more complete understanding of part of Earth's history.

Generalized Stratigraphic Column



Geologic Terms

Basalt: A dark-colored volcanic rock composed of magnesium and iron-rich minerals.

Claystone: A fine-grained sedimentary rock. Claystone at John Day Fossil Beds was formed through weathering of volcanic ash that was incorporated into ancient soils.

Conglomerate: A sedimentary rock composed of rounded particles of varying size, from clay to boulder. Usually indicative of deposition in fast-moving or turbulent water.

Formation (Fm): The primary formal unit used in the study of sedimentary rocks to classify strata. A series of rock layers with similar properties.

Ignimbrite: A rock formed from a pyroclastic flow, which is a hot, fast-moving cloud of gas and other explosively erupted volcanic material.

Lahar: A deposit produced by a volcanic mudlfow.

Ma (Mega annum): A million years.

Member: A formal subunit of a geological formation. Each member of a formation has properties distinguishing it from adjacent members.

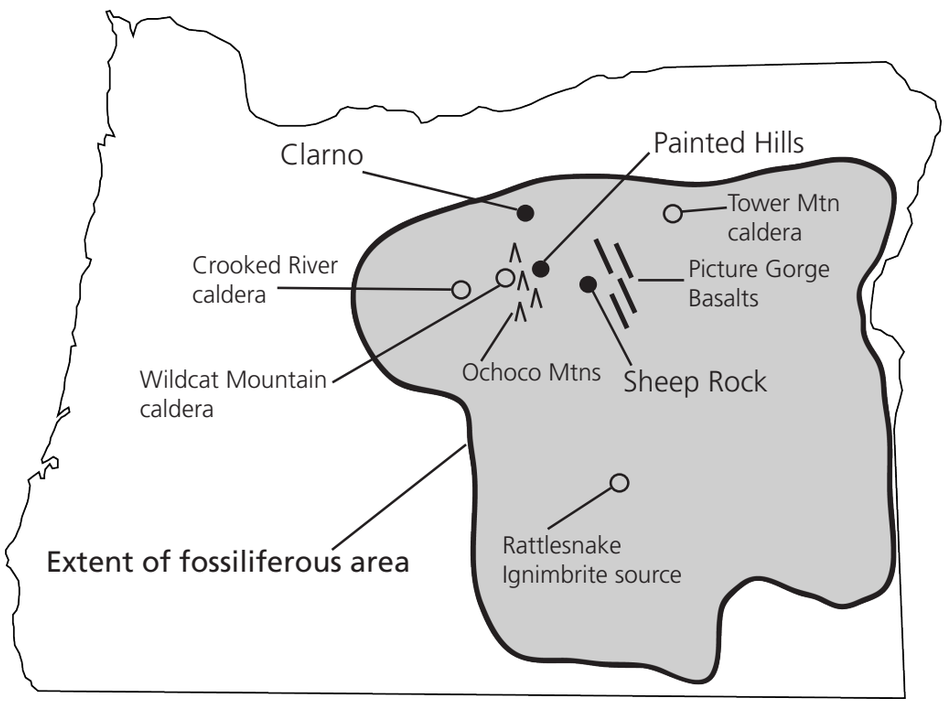
Stratigraphic column: A visual, scaled representation of the vertical distribution of rock layers in a region.

Stratum (pl. strata): A layer of sedimentary rock having a consistent composition, which enables it to be distinguished from other strata.

Tuff: A rock formed from consolidated volcanic ash and cinders.

Volcanic Sources of Ancient Oregon

Though the fossils of the John Day region are preserved in sedimentary rocks, these rocks are made up of materials from volcanic eruptions. Once deposited, the ash and tuff from these eruptions weather into soils, and solidify with burial and pressure into claystones and siltstones. The original sources for these volcanic materials can be found throughout eastern and central Oregon.



The earliest of these is the Clarno Formation, whose primary source is an extinct range of volcanoes that now make up part of the Ochoco Mountains. Remnants of this volcanic chain can still be seen in the cone-shaped hills near Mitchell.

The younger rocks of the John Day Formation were likely formed due to the activities of a large volcanic field. Calderas are all that remain of these volcanoes, which would have produced alternating basalt and ash eruptions throughout the late Eocene and early Oligocene. The three known calderas of this volcanic field include the Crooked River caldera, near present-day Prineville, the Wildcat Mountain caldera between Prineville and the Painted Hills, and the Tower Mountain caldera northeast of Sheep Rock.

The Picture Gorge Basalts were part of an extensive period of volcanism in the Pacific Northwest. The most likely source for these particular basalts was a series of fissures just east of the Sheep Rock area. The volcanic source for the Mascall formation has not yet been pinpointed, but possibilities include the modern Cascades and the McDermitt volcanic field near the Oregon-Nevada border. The ash in the most recent fossil formation, the Rattlesnake, originates from a source near the town of Burns.